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A PLEA FOR LESS FORMAL WORK IN MATHEMATICS.

By F. M. MORGAN, Dartmouth College.

An American professor of mathematics while abroad was told by one of his English colleagues, that American mathematical text-books looked as if they had been written for the feeble-minded. The American professor replied: "Perhaps that is so but your text-books look as if they had been written by the feeble-minded." Now I feel like Sir Roger de Coverly when he said "Much may be said on both sides." However in this brief paper I intend to discuss the question only from the foreign professor's point of view.

First I ask why should our American texts as a whole call for such a remark? I believe we do not have to look far in order to find the answer. It lies in the fact that the majority of them contain too may rules and formulæ. They are written chiefly with the idea of cramming a student to pass an examination and not with the idea of teaching him mathematics. The stimulus for original thinking is therefore sacrificed, everything being done by a cut and dried rule. Many of our texts make mathematics a subject for memory instead of a subject for reason. They try to feed the student mathematics in the form of little sugar-coated pills.

There are of course certain rules and formulæ which are fundamental to the science. These must be taught to, and memorized by, the student. There are others which are not fundamental and should not be taught, for generally these non-important rules and formulæ hold as prominent a place in the student's mind as the important ones do. Let me illustrate my point by a concrete example. A large number of our American text-books on algebra give the following rule for evaluating a third order determinant: "Rewrite the first and second columns to the right of the determinant. The diagonals running down from left to right give the positive terms. The diagonals running down from right to left give the negative terms." Now this rule is so simple that any child can use it, but I ask, of what real good is the rule? It does not apply to a determinant of any other order, and therefore it is not a rule fundamental to the study of determinants. Expansion by means of minors is just as easy, and it is, moreover, fundamental to the subject since it may be applied to a determinant of any order.

Then we have rules in which the emphasis on the fundamental principle is sacrificed in order to make the rule short so that a student without mental effort may solve a problem of that type. Let me also illustrate this point by means of the usual rule for finding the equation of a straight line through a given point and parallel to a given line: "*Step* 1. Change the constant term in the given equation to k. *Step* 2. Substitute the coördinates of the given point in the equation of step 1 and solve for k. *Step* 3. Substitute this value of k in the equation of step 1, and the result is the desired equation." This rule, like the one on determinants, is easy to learn and apply, but what real knowledge of analytic geometry has the student gained by learning it? How many students really know why the above rule gives the desired result and not, for example, the equation of a line through the given point and perpendicular to the given line? Very few, it will be found, really know. The reason for this is that the fundamental principle involved, namely that parallel lines have the same slope but different intercepts on the y axis, has been mentioned implicitly and not explicitly. If such rules as the above (and there are many more of the same type) were written so that the fundamental principle involved were explicitly stated, the student would benefit greatly thereby.

Experience makes it certain that a student learns more mathematics, can pass a better examination (if that is a criterion for excellency in the subject) if he knows the fundamental formulæ, the fundamental principles, and has been taught to reason and not memorize.

BOOK REVIEWS.

Edited by W. H. Bussey.

Advanced Algebra. By Joseph V. Collins. American Book Company, New York. x + 342 pages. $1.00.

The subject matter for a freshman course in algebra as presented in the great majority of text books does not vary much. This book differs slightly from the usual algebra in this respect. It is divided into three parts. Part I, containing five chapters, is devoted to a review of the elementary algebra through simultaneous quadratics. At the end of chapter four is a list of the fundamental principles. This is followed by a short explanation of the most common errors arising from not following these principles. The fifth chapter contains a list of the theorems of plane geometry used in the rest of the book.

Part II is made up of the chapters on graphs, ratio and proportion, logarithms, the progressions, annuities, the binomial theorem, and inequalities. The author makes evident the connection between algebra and trigonometry by following proportion with the definitions of sine, cosine, tangent and cotangent, and applying these to problems involving right triangles.

In Part III are found the topics which belong to advanced algebra proper; namely, theory of equations, permutations and combinations, probability, determinants, series, undetermined coefficients, continued fractions, and complex numbers. Some of these topics are discussed very briefly. The student is supposed to get many of the principal facts of the subject from simple, concise proofs, yet he is not burdened with too much theory of the kind which does not appeal to the average freshman. In dealing with the complex number, the addition theorem of trigonometry is derived for use in establishing De Moivre's theorem. A further connection between algebra and trigonometry is thus made.

At various places short historical notes are added. These consist, for the most part, of biographical sketches of great mathematicians, and are so placed